Wagner Free Institute of Science

of Philadelphia

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Annual Announcement 1913-14

... Wilson Edge Institute of Science

Wagner
Free Institute of Science
of Philadelphia

ANNUAL
ANNOUNCEMENT

Sixty-Sixth Year

Philadelphia

1913

TRUSTEES

President, Samuel Wagner.
Secretary, Joseph Willcox.
Treasurer, J. Vaughan Merrick.

Sydney T. Skidmore.
Samuel T. Wagner.
Harrison S. Morris.
Henry Leffmann.

FACULTY

William Healey Dall, A.M., Sc.D.
Honorary Professor of Invertebrate Paleontology.

Henry Leffmann, A.M., M.D., Ph.D.
Honorary Professor of Chemistry.

William B. Scott, A.M., Ph.D., LL.D.
Honorary Professor of Geology.

George F. Stradling, Ph.D.
Honorary Professor of Physics.

Samuel Tobias Wagner, B.S., C.E.
Professor of Engineering.

Spencer Trotter, M.D.
Professor of Zoölogy.

Samuel C. Schmucker, Ph.D.
Professor of Botany.

Leslie B. Seely, B.A.
Professor of Physics.

Charles H. LaWall, Ph.M.
Professor of Organic Chemistry.

David W. Horn, Ph.D.
Professor of Inorganic and Physical Chemistry.

Benjamin L. Miller, Ph.D.
Geology.

John G. Rothermel, *Superintendent.*

Historical Note.

The Wagner Free Institute of Science owes its establishment to the liberality and public spirit of William Wagner and his wife Louisa Binney Wagner. In his early life Professor Wagner made extensive voyages in the service of Stephen Girard, and had opportunities to visit scientific institutions and make the acquaintance of scientific workers. He soon developed a strong interest in the natural sciences, especially geology and mineralogy, and devoted a large part of his life to studying these topics and collecting material to illustrate the teaching of them.

In 1847 he began to give free lectures at his home, near the present location of the Institute building, at that time in the rural section of the county. In 1855 the Institute was incorporated by the Legislature, a faculty was appointed and lectures were given at Commissioners' Hall, Thirteenth and Spring Garden Streets, by permission of the city authorities. In a few years the city was obliged, by its own needs, to withdraw the privilege of the

hall, and Professor Wagner arranged to erect a suitable building on his own property. This was completed in May, 1865, and lectures at once given in it. In 1864 a deed of trust was executed by Professor Wagner and his wife, furnishing a permanent endowment of the Institute.

In 1885, by the death of the founder, the care of the Institute passed entirely into the hands of a Board of Trustees, and since then many improvements have been made in the building, and extensive additions to its equipment in the museum and library and in scientific apparatus. In 1901 a wing was built for the use of a branch of the Free Library of Philadelphia.

The lecture-room is capable of seating about six hundred persons and is equipped with excellent lecture facilities. The collection of physical apparatus comprises many of the older forms which have historic interest and a large number of the most recent invention and construction.

FACILITIES FOR INSTRUCTION.

Lectures and Class-work.

Instruction at the Wagner Free Institute of Science is conducted by means of public lectures, supplemented by class-work, and is without charge and without restriction of race or sex. The class-instruction is given partly

at the close of each lecture, partly by written exercises. The museum and reference library of the Institute are available for aid in the instruction work and are freely used. In addition, the Wagner Free Institute Branch of the Free Library of Philadelphia affords abundant opportunities for collateral reading.

At the close of each course of lectures an examination is held, to which those who have attended the classes are admitted, and on passing such examination the pupil is awarded a certificate. Certificates are awarded at a public meeting held in May of each year.

The lecture courses are arranged to cover a given topic in four successive years, and to those who hold certificates for each of these courses, a full-term certificate is issued.

Holders of full-term certificates are eligible to membership in the Alumni Association. For information in regard to this see page 8.

Museum and Libraries.

The Museum covers the whole field of natural science and contains illustrations of all departments of biology, geology, mineralogy, metallurgy and engineering. The specimens are arranged so as to be easily studied and are open to inspection from 2 to 5 o'clock Wednesday and Saturday afternoons, except legal holidays.

The reference library contains text-books and works of reference in all departments of science, encyclopedias, many works devoted to literature and an assortment of dictionaries of English, classical and foreign languages. It is open on all regular business days from 9 a. m. to 9.30 p. m., a librarian being always in attendance to assist students.

The circulating library is a branch of the Free Library of Philadelphia. It is open every business day from 9 a. m. to 9 p. m. Books may be taken out under the usual rules of the Free Library. Many periodicals—American and foreign, scientific and literary—are on file.

ACCESSORY SCIENTIFIC WORK.

Two scientific societies meet regularly at the Institute. The Philadelphia Natural History Society meets on the third Thursday of each month except June, July and August, the Philadelphia Mineralogical Club on the second Tuesday of each month except July and August. These meetings are open to all persons.

The Alumni Association holds a public meeting on the third Tuesday in January of each year.

UNIVERSITY EXTENSION LECTURES.

Courses of lectures under the auspices of the American Society for the Extension of

University Teaching and The Free Library of Philadelphia are given regularly in the hall of the Institute, and are open to all without charge. These courses embrace a wide range of topics, being usually outside of the scope of the regular Institute courses.

SCHOOL CHILDREN LECTURES.

Under the auspices of The Free Library of Philadelphia illustrated lectures are given to school children on Tuesday afternoons during the winter season. These are elementary and relate to travel, science, history and biography. Small classes of children are also given brief instruction in a "Story Hour."

SPECIAL LECTURES.

By the liberality of Richard Brodhead Westbrook, D.D., for many years a trustee of the Institute, and his wife, Henrietta Payne Westbrook, provision has been made for lectures independent of the general courses of the Institute and covering a wide range of topics.

The 1912–13 course under this endowment consisted of four lectures on "Conservation of Natural Resources," as follows:

"A Glance Over the Field," Gifford Pinchot, *President, National Conservation Association.*

"Water as Resource," Marshall O. Leighton, *Chief Hydrographer, U. S. Geological Survey.*

"What Shall We Do With Our Forests?" Overton W. Price, *Vice-President, National Conservation Association.*

"Saving Life and Resources in the Mining Industry," Joseph A. Holmes, *Director, Bureau of Mines, Department of Interior.*

Arrangements are being made for the publication of these lectures in book form.

The course for the session of 1913–14 is being arranged, and details will be announced in a special publication

RESEARCH.

The Institute has maintained research work since 1885, and has published six complete volumes of transactions and the first part of a seventh volume. A list of the subjects will be found on page 24. In addition, the income of a special fund is available for lectures and research in chemistry. The results of an investigation of the effects of heat on starches are now being prepared for publication in the *Transactions.*

ALUMNI ASSOCIATION.

The Alumni Association was organized in 1907, composed of those who have received degrees or full-term certificates of the Institute.

The officers for 1913 are:

President, Henry Leffmann.

Vice-Presidents, Daniel G. Alrich, Edward W. Siegmann.
Secretary, Edgar T. Wherry.
Treasurer, W. C. Hambel.
Advisory Council, P. Caledon Cameron, William J. Reinhold, Maximilian Weiss, and the above-named officers.

The Association holds a meeting in January of each year, which is preceded by a public meeting at which a lecture on some scientific topic is given.

At the annual meeting of 1913 an illustrated lecture on "The Geology of the Philadelphia District" was delivered by Dr. Edgar T. Wherry.

CLOSING EXERCISES.

In May of each year the courses of instruction are formally closed by a public meeting at which addresses are given and the certificates awarded.

At the closing exercises in May, 1913, after an address by Professor Samuel T. Wagner, President of the Faculty, and awarding of certificates, Dr. Oliver P. Hay, of the Carnegie Institution of Washington, delivered an illustrated lecture on "The Age of Ice and Its Animals."

FULL-TERM CERTIFICATES

CHEMISTRY

William Knabe

BOTANY

William Knabe

PHYSICS

Harry Gehris, Jr.
William Knabe
John A. Meunier

1912-13 CERTIFICATES

ENGINEERING 2

Alfred C. Bauer
R. C. Kratz
Herman A. Krueger
Palmer Bescherer
William Knabe
William H. Pahl
John A. Kelley
Raymond H. Krecker
William A. Taylor

ORGANIC CHEMISTRY 4

P. C. Cameron
William Knabe

ZOÖLOGY 2

P. C. Cameron
Elizabeth Kirk
Sarah E. Fisher
Nathaniel Spekofski

PHYSICAL CHEMISTRY 2

Thomas Darlington
William Knabe
William J. M. Devine
Francis W. Hartzell
R. Ralph Richter

BOTANY 2

Sarah E. Fisher
Carleton Linsley
Laila S. Jones
Hugh F. Munro
William Knabe
Nathaniel Spekofski

PHYSICS 3

S. P. Byrnes
Harry Gehris, Jr.
John A. Meunier
Joseph Cusworth
Francis W. Hartzell
George W. Richards
Georgianna White
Thomas Darlington
William Knabe
R. Ralph Richter

GEOLOGY 2

Morrell G. Biernbaum
William Knabe
Allan G. Stern
Samuel G. Gordon
R. Ralph Richter
Howard E. Stern
Georgianna White
Herbert H. Haas
Robert Rosenbaum
Harry W. Trudell

REGULAR LECTURES
SESSION OF 1913–1914

ENGINEERING 3.

PROFESSOR SAMUEL T. WAGNER.

Roads, Railroads and Tunnels.

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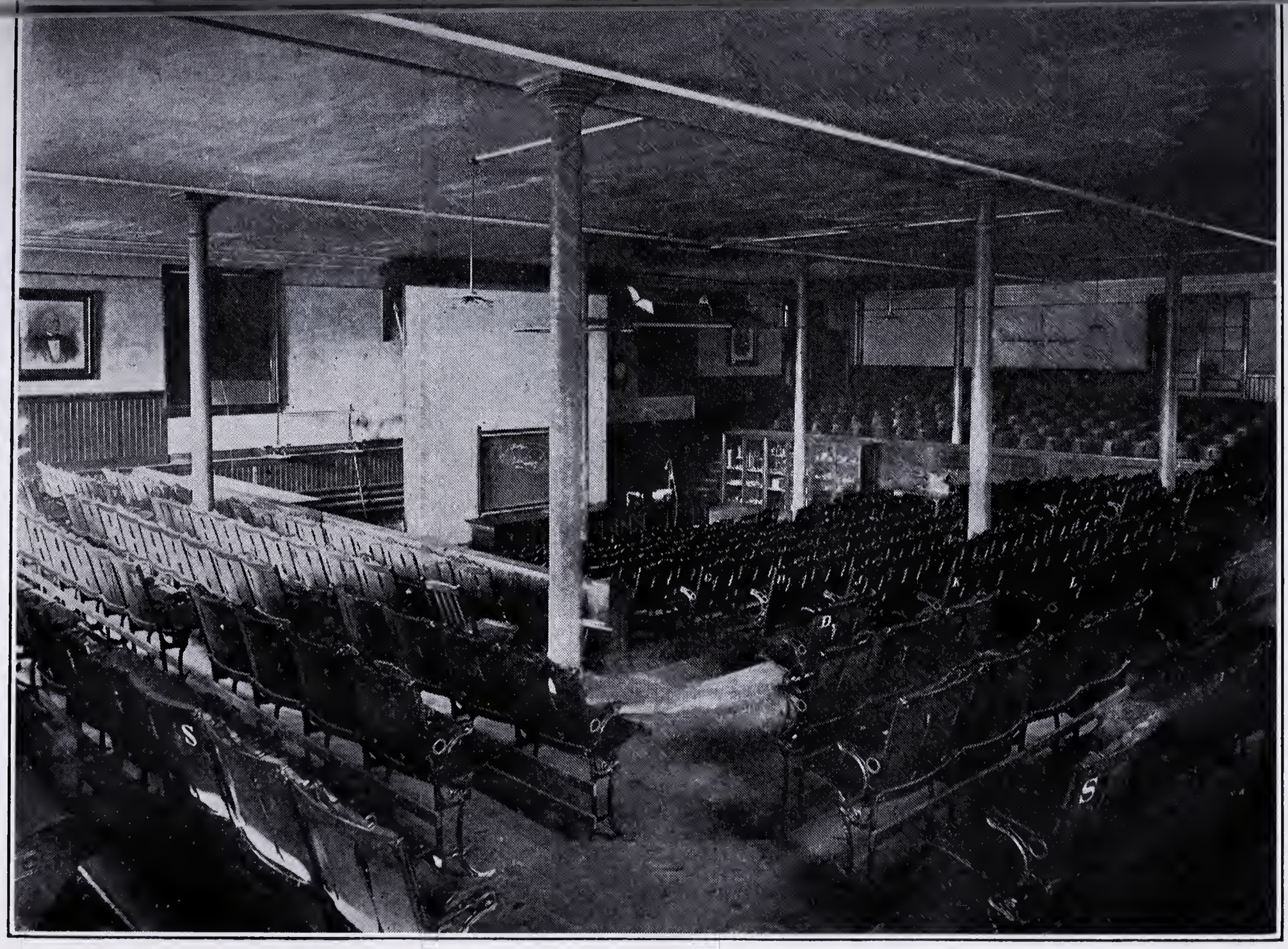
1. Friday, September 5.
   Engineering Location. Surveying. Making the Measurements. Measuring Straight Lines. Measuring Angles. Field Work.
2. Friday, September 12.
   Engineering Location. Vertical Measurements. The "Y" Level. Barometer. Field Work. Topography. Contours. Plane-table.
3. Friday, September 19.
   Roads and Streets. Definitions. Reconnaisance. Preliminary Surveys. Maps. Profiles. Location. Points Determining Best Location.
4. Friday, September 26.
   Roads and Streets (Continued). Earthwork. Drainage. Foundations.



AUDITORIUM

5. Friday, October 3.

Roads and Streets (Continued). Surfacing. Natural Dirt Roads. Gravel Roads. Broken Stone Roads; Macadam.

6. Friday, October 10.

Roads and Streets (Continued). Telford Roads. Granite Block Streets. Asphalt Streets.

7. Friday, October 17.

Roads and Streets. (Concluded). Wood Pavements. Concrete Pavements. Relative Merits of Pavements. Repairs. Economic Importance. History.

8. Friday, October 24.

Railroads. Economic Location. Details of Location Estimates. Railroad Curves. Field Work.

9. Friday, October 31.

Railroads (Continued). Earthwork. Machinery Used. Drainage. Ballast. Ties.

10. Friday, November 7.

Railroads (Continued). Rails. Frogs. Switches. Crossings.

11. Friday, November 14.

Railroads (Continued). Signals: Block; Interlocking. Turntables. Snow Sheds and Fences. Rolling Stock and Locomotives.

12. Friday, November 21.

Railroads (Continued). Cars. Stations. Terminals. Bridges. Elevated Railroads.

13. Friday, November 28.

Railroads (Concluded). Underground Railroads. Use of Electricity. Street Railways. Rack Railroads.

14. Friday, December 5.

Tunnels. Location. Where Used. General Principles of Construction.

15. Friday, December 12.

Tunnels (Continued). Shafts. Headings. Driving in Soft Ground; in Rock. Blasting. Explosives. Ventilation.

16. Friday, December 19.

Tunnels (Concluded). Cross-sections. Packing. Rate of Progress and Cost. Submarine Tunnels. Shield Method of Driving. Special Examples.

ZOÖLOGY 3.

PROFESSOR SPENCER TROTTER.

Vertebrates.

1. Monday, October 20.

Vertebrate Characters. Review of Vertebrate Classes. Origin and Relationships of Vertebrates.

2. Monday, October 27.

Fishes. Characters of the Group. The Cyclostomes. Life and Environment of Fishes.

3. Monday, November 3.

Fishes (Continued). Subclasses. Sharks and Their Allies, Ganoids. Dipnoi. Teleosts or Bony Fishes. Orders of Teleosts.

4. Monday, November 10.

Batrachians or *Amphibians*. Characters. Subclasses. Tailed and Tailless Form.

Study of the Frog. Relations to Other Forms. Significance of Amphibians in the Scheme of Development.

5. Monday, November 17.
   Reptiles. Characters; Geologic History, Life and Environment. Classification.
6. Monday, November 24.
   Reptiles (Continued). Review of the Orders. Lizards, Serpents, Turtles, Crocodiles.
7. Monday, December 1.
   Birds. Characters, Geologic History and Origin. Reptilian Affinities. Life and Environment. Flight. Classification.
8. Monday, December 8.
   Birds (Continued). Review of the Orders of Living Birds.
9. Monday, December 15.
   Mammals. Character, History and Relationships. Three Subclasses. Monotremes. Marsupials.
10. Monday, December 22.
    Mammals (Continued). Review of the Orders. Eutherian Mammals. Concluding Remarks.

INORGANIC CHEMISTRY 1.

PROFESSOR DAVID W. HORN.

General Principles. Notation. Nomenclature.

1. Monday, September 8.

   Scope of Chemical Science. Distinctions between Physical and Chemical Change. Characters of Chemical Change (Color, Odor, Solubility and Other Changes in Properties). Rapidity of Chemical Change and Necessity for Close Contact of Reacting Bodies.

2. Monday, September 15.

   Definiteness of Chemical Action. Law of Constant Proportion. Indestructibility of Matter. Idea of the Element (Transmutation of Elements?).

3. Monday, September 22.

   Atomic Theory. Atomic Weights; Molecular Weights. Electrons. Symbols and Their Use. Reactions Illustrating Use of Symbols.

4. Monday, September 29.

   Chemical Affinity. Conditions Influencing It. Effect of Fine Division, Solution, Physical State. Effect of Ordinary Physical Forces.

5. Monday, October 6.

   Principal Types of Inorganic Compounds. Acids, Bases and Salts, Ionization. Indicators and Their Uses.

6. Monday, October 13.

   Inorganic Nomenclature. Illustrations of Its Use.

ORGANIC CHEMISTRY 1.

PROFESSOR CHARLES H. LaWALL.

General Principles. Hydrocarbons.

1. Wednesday, October 15.
   Nature and Composition of Organic Substances. Distinction between Organic and Organized. General Tests for Organic Substances.
2. Wednesday, October 22.
   Transformations of Organic Substances. The So-called "Natural Changes." Fermentation, Putrefaction and Decay.
3. Wednesday, October 29.
   Transformations (Continued). Destructive Distillation. Substitution. Metallic-organic Substances. Classification of Organic Substances.
4. Wednesday, November 5.
   Molecular Structure. Isomerism, Metamerism, Stereo-chemistry. Optical Activity.
5. Wednesday, November 12.
   Hydrocarbons. Principal Types. Homologous Series. Paraffins (Methanes).
6. Wednesday, November 19.
   Methanes (Continued). Natural Gas. Petroleum and Products. Coal Gas. Bitumens.
7. Wednesday, November 26.
   Ethenes (*Olefins*). Alcohol Radicles. Derivatives of Hydrocarbons.
8. Wednesday, December 3.
   Alcohols. Grain and Wood Alcohol. Fusel Oil. Alcoholic Beverages.

9. Wednesday, December 10.

   Ethers and *Esters*. Ethyl Ether. Flavoring Ethers. Aldehydes.

10. Wednesday, December 17.

    Esters (Continued). Esterification, Saponification and Hydrolysis of Esters.

BOTANY 3.

PROFESSOR SAMUEL C. SCHMUCKER.

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1. Monday, January 5.

   The Grasses and Their Allies. The Jointed Stems; the Two-ranked Leaves; the Chaffy Flowers. Grasses, Sedges and Rushes.

2. Monday, January 12.

   The Lillies and Their Allies. The Colored Perianth: the Bulbous Bases. Pineapples and Bananas. Amarylids, Irids and Orchids.

3. Monday, January 19.

   Aroids and Catkins. Spadix and Spathe. Protective Crystals. Catkin Bearing Trees. Willows, Birches, Walnuts, Oaks.

4. Monday, January 26.

   Buttercups and Their Allies. The Simple Flower. The Place of Color. Complications of Structure. The Magnolias and Water-lilies.

5. Monday, February 2.

   Mustards and Roses. Pungency and Thrift. Sea-kale and Its Variations. The Flower of the Rose. The Fruit Group.

6. Monday, February 9.

   The Pea Family. The Butterfly Flower. Its Complex Fertilization. The Legume. Bacterial Symbiosis. The Tree Habit.

7. Monday, February 16.

   Heaths and Nightshades. Cold Resistance. Gamopetaly. The Berry. The Alkaloid Poisons; their Origin and Function.

8. Monday, February 23.

   Figworts and Mints. Parallelism. The King's Evil. The Aromatic Plants. Essential Oils.

9. Monday, March 2.

   The Composite Family. The involucre; the Clustered Flowers; Tubular and Strap-shaped Corollas; Disc and Ray Flowers. Thistles, Daisies and Dandelions.

10. Monday, March 9.

    The Pedigrees of Flowers. Uncertain Beginnings. Palms, Aroids and Catkins. From Lilies to Orchids. Buttercups to Peas. Carrots to Dandelions.

PHYSICS 4.

PROFESSOR LESLIE B. SEELY.

Electricity and Magnetism.

1. Friday, January 2.

   Static Electricity. Historical Sketch. Nature of Electricity. Charges and Currents. Two Kinds of Charges. Law of Electrical Attraction and Repulsion. Static Machines. Potential and Capacity Condensors. Action of Points. Lightning.

2. Friday, January 9.

Electric Cells. The Voltaic Cell. An "Electric" Current. Unit of E. M. F. or Pressure. Source of Energy in Voltaic Cell. Local Action. Polarization. Voltaic Batteries. Open and Closed Circuit Cells. Storage Cells. Thermo-electric Currents.

3. Friday, January 16.

Electrolysis. Electrolytic Conductors. Action in Electrolytic Cells. Laws of Faraday. Chemical Equivalent and Electrochemical Equivalent. Voltameter.

4. Friday, January 23.

The Flow in Circuits. Conductivity. Resistance, Pressure and Current Flow. Ohm's Law. Electrical Units. Specific Resistance of Conductors.

5. Friday, January 30.

The Flow in Circuits (Continued). Resistance of Wire Circuits. Circuits in Parallel and in Series. Shunts. Fall of Pressure along a Circuit. Connection of Cells in Parallel and in Series.

6. Friday, February 6.

The Flow in Circuits (Continued). Heat Effects of Current. Electrical Work and Power. Conservation of Energy. Relation of Electrical Units to Mechanical Units.

7. Friday, February 13.

Magnetism. Historical sketch. Natural and Artificial Magnets. Two Kinds of Poles. Law of Magnetic Attraction and Repulsion. Magnetic Induction. Nature of

Magnetism. Magnetic Fields. Terrestrial Magnetism.

8. Friday, February 20.

Magnetic Effects of Current. Effect on Magnetic Needle. The Field Produced by a Current. Rules for Determining the Direction of the Field. Fields Produced by Coils. Electromagnets. Permeability and Reluctance. The Magnetic Circuit.

9. Friday, February 27.

Electromagnetic Induction. Conductor Moving across a Magnetic Field. Early Magneto Machines. Direction and Magnitude of Induced Pressure. Coil in Magnetic Field Induction Coils. Lentz's Law. Spark Coils.

10. Friday, March 6.

Measuring Instruments. Galvanometer. Voltmeters and Ammeters. Wattmeter.

11. Friday, March 13.

Measurement of Resistances. Measurement by Substitution. Resistance Boxes. Wheatstone's Bridge and Its Uses. Volt and Ampere Method of Measuring Resistances.

12. Friday, March 20.

Direct Current Dynamos and Motors. Field Magnets. Bi-polar and Multi-polar Machines. Armatures. Commutator. Series, Shunt and Compound Winding for Fields.

13. Friday, March 27.

Alternating Currents. Representation of A C by a Curve. Self-induction. Lag. Impedance.

14. Friday, April 3.

Alternating Currents (Continued). Ohm's Law Applied to A C Power Curves. Measuring Instruments for A C Use.

15. Friday, April 17.

Principles Underlying Some Common Electrical Instruments. Telephone. Telegraph. Wireless Telegraph. Electric Lamps.

16. Friday, April 24.

Theory of the Electrical Constitution of Matter. The Becquerel Rays. Radium and Its Products. The Molecular Constitution of Electricity.

GEOLOGY 3.

BENJAMIN L. MILLER, PH.D.

Physiographic Geology.

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1. Wednesday, January 7.

Topographic Criteria for Interpretation of Past Changes.

2. Wednesday, January 14.

Characteristics of Shore Lines.

3. Wednesday, January 21.

Characteristics of Coastal Plains.

4. Wednesday, January 28.

Characteristics of Inland Plains and Peneplains.

5. Wednesday, February 4.

Characteristics of Mountains Produced by Folding and Faulting.

6. Wednesday, February 11.
   Characteristics of Mountains Produced by Folding and Faulting (Continued).
7. Wednesday, February 18.
   Characteristics of Volcanic Mountains.
8. Wednesday, February 25.
   Life Histories of Rivers.
9. Wednesday, March 4.
   Life Histories of Lakes.
10. Wednesday, March 11.
    Topographic Erosional Forms of Humid Regions.
11. Wednesday, March 18.
    Topographic Erosional Forms of Arid Regions.
12. Wednesday, March 25.
    Topographic Characteristics of Glaciated Regions.
13. Wednesday, April 1.
    Physiographic Regions of the United States and Their Influence on the Development of the Nation.
14. Wednesday, April 8.
    Types of Physiography Represented in Pennsylvania and Their Influences on the Development of the State.
15. Wednesday, April 15.
    Types of Physiography Represented in Pennsylvania and Their Influence on the Development of the States (Continued).
16. Wednesday, April 22.
    Topographic History of Philadelphia and Vicinity.

PUBLICATIONS OF THE INSTITUTE

Vol. 1.—Explorations on the West Coast of Florida and in the Okeechobee Wilderness. Angelo Heilprin.

Vol. 2.—Report on Fresh-water Sponges Collected in Florida. Edward Potts.
Notice of Some Fossil Human Bones. Joseph Leidy.
Description of Mammalian Remains from Rock Crevice in Florida. Joseph Leidy.
Description of Vertebrate Remains from Peace Creek, Florida. Joseph Leidy.
Notice of Some Mammalian Remains from Salt Mine of Petite Anse, Louisiana. Joseph Leidy.
On Platygonus, an Extinct Genus Allied to the Peccaries. Joseph Leidy.
Remarks on the Nature of Organic Species. Joseph Leidy.

Vol. 3.—Parts 1, 2, 3, 4, 5, 6.—Contributions to the Tertiary Fauna of Florida.
William H. Dall.

Vol. 4.—Fossil Vertebrates from the Alachua Clays, Florida. Joseph Leidy.

Vol. 5.—Study of Hawaiian Skulls.
Harrison Allen.

Notes on the Palæontological Publications of Prof. Wm. Wagner.
William H. Dall.

Vol. 6.—Selenodont Artiodactyls of the Uinta Eocene. W. B. Scott.

Vol. 7.—Contributions to the Mineralogy of the Newark Group in Pennsylvania.
Edward T. Wherry.

A Comparative Study of the Radio-Active Minerals in the Collection of the Wagner Free Institute of Science.
Carl Boyer and Edgar T. Wherry.
(*In press*)

Studies in Carbohydrates.
Charles H. LaWall and Sarah S. Graves.